Heat-related mortality risk model for climate change impact projection

Author(s): Honda Y, Kondo M, McGregor G, Kim H, Guo YL, Hijioka Y, Yoshikawa M, Oka K, Takano S, Hales S, Kovats RS

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Abstract:

Objectives: We previously developed a model for projection of heat-related mortality attributable to climate change. The objective of this paper is to improve the fit and precision of and examine the robustness of the model. Methods: We obtained daily data for number of deaths and maximum temperature from respective governmental organizations of Japan, Korea, Taiwan, the USA, and European countries. For future projection, we used the Bergen climate model 2 (BCM2) general circulation model, the Special Report on Emissions Scenarios (SRES) A1B socioeconomic scenario, and the mortality projection for the 65+-year-old age group developed by the World Health Organization (WHO). The heat-related excess mortality was defined as follows: The temperature-mortality relation forms a V-shaped curve, and the temperature at which mortality becomes lowest is called the optimum temperature (OT). The difference in mortality between the OT and a temperature beyond the OT is the excess mortality. To develop the model for projection, we used Japanese 47-prefecture data from 1972 to 2008. Using a distributed lag nonlinear model (two-dimensional nonparametric regression of temperature and its lag effect), we included the lag effect of temperature up to 15 days, and created a risk function curve on which the projection is based. As an example, we perform a future projection using the above-mentioned risk function. In the projection, we used 1961-1990 temperature as the baseline, and temperatures in the 2030s and 2050s were projected using the BCM2 global circulation model, SRES A1B scenario, and WHO-provided annual mortality. Here, we used the "counterfactual method" to evaluate the climate change impact; For example, baseline temperature and 2030 mortality were used to determine the baseline excess, and compared with the 2030 excess, for which we used 2030 temperature and 2030 mortality. In terms of adaptation to warmer climate, we assumed 0 % adaptation when the OT as of the current climate is used and 100 % adaptation when the OT as of the future climate is used. The midpoint of the OTs of the two types of adaptation was set to be the OT for 50 % adaptation. Results: We calculated heat-related excess mortality for 2030 and 2050. Conclusions: Our new model is considered to be better fit, and more precise and robust compared with the previous model.

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Resource Description

Climate Scenario : ☑

specification of climate scenario (set of assumptions about future states related to climate)

Other Climate Scenario

Other Climate Scenario: SRES A1B

Exposure :

weather or climate related pathway by which climate change affects health

Temperature

Temperature: Extreme Heat, Fluctuations

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Geographic Location:

resource focuses on specific location

Non-United States

Non-United States: Asia

Asian Region/Country: Other Asian Country

Other Asian Country: Japan

Health Impact:

specification of health effect or disease related to climate change exposure

Injury, Other Health Impact

Other Health Impact: heat related mortality

Mitigation/Adaptation:

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology:

type of model used or methodology development is a focus of resource

Outcome Change Prediction

Population of Concern: A focus of content

Population of Concern:

populations at particular risk or vulnerability to climate change impacts

Elderly

Resource Type:

format or standard characteristic of resource

Research Article

Timescale: ☑

time period studied

Medium-Term (10-50 years)

Vulnerability/Impact Assessment: ☑

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content